

Ancient Gene Transfer to the Ancestor of Opisthokonts

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Lateral gene transfer across boundaries of species brings new enzymes, pathways, and other novelties to host organisms and plays an important role in the evolution of life. Events of ancient gene transfer occurred during early evolutionary time. Considering the possibility that the novelties brought up by these ancient events are retained among descendent lineages and subsequently shape their genetic systems, ancient gene transfer theoretically plays a far greater role in evolution than those occurring to specific lineages or in more recent evolutionary time.

We here report the lateral transfer of the gene encoding tyrosyl-tRNA synthetase (tyrRS) from archaea to the ancestor of opisthokonts. Our sequence comparisons show that eukaryotic tyrRSs apparently fall into two major groups. The opisthokont tyrRS sequences are similar to their homologs from euryarchaeota. In particular, opisthokont tyrRSs share several indels with that of the archaeon *Haloarcula marismortui*. On the other hand, tyrRS sequences from the remaining eukaryotes, including parabasalid *Trichomonas*, diplomonad *Giardia*, amoebzoa, alveolates, kinetoplastids, green plants, and red algae, are similar to those of crenarchaeota and nanoarchaeota. The two groups of eukaryotic tyrRSs were further supported by phylogenetic evidence.

The different origins of tyrRS lineages between opisthokonts and the remaining eukaryotes clearly indicate an ancient lateral gene transfer of tyrRS from an archaeon to the ancestor of opisthokonts. The fact that anciently transferred tyrRS unites the opisthokonts also points to the potential utility of ancient gene transfer events as molecular markers for major organismal lineages.